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36. Proposed by O. W. ANTHONY, Mexico, Missouri.

From two points, one on each of the opposite sides of a parallelogram, lines are drawn to the opposite vertices. Through the points of intersection of these lines a line is drawn. Prove that it divides the parallelogram into two equal parts.

Solution by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, in the University of Mississippi, University P. O., Mississippi.

Let $OACB$ be the parallelogram, O the lower left-hand vertex, OA the base, D and E points on OA and CB respectively.

If $OA=b$, $OC=a$, $OD=n$, $CE=m$, then, taking OA as the X -axis and OC as the Y -axis, the points O, A, B, C, D , and E will be given by the co-ordinates $(0,0), (b,0), (b,a), (0,a), (n,0)$, and (m,a) respectively.

It follows that the equation of OE is $\frac{y}{a} = \frac{x}{m}$; (1).

The equation of CD is $\frac{y}{a} + \frac{x}{n} = 1$; (2).

The equation of BD is $y = \frac{-a}{n-b} (x-n)$ (3).

The equation of EA is $y = \frac{-a}{b-m} (x-b)$ (4).

From (1) and (2) the intersection of OE and CD is

$$\left(\frac{mn}{m+n}, \frac{an}{m+n} \right) \text{ which denote by } (x', y').$$

From (3) and (4) the intersection of BD and EA is

$$\left(\frac{b^2 - mn}{2b - m - n}, \frac{-a(n-b)}{2b - m - n} \right) \text{ which denote by } (x'', y'').$$

The equation of the line passing through these points of intersection is

$$y - y' = \frac{y' - y''}{x' - x''} (x - x') \dots (5).$$

If the center of the parallelogram is on this line its co-ordinates,

$$\left(\frac{b}{2}, \frac{a}{2} \right), \text{ will satisfy (5).}$$

Substituting and reducing, $\frac{1}{2} - \frac{n}{m+n} = \frac{m-n}{2(m+n)}$, or (5) is satisfied.

Since every line which passes through the center of a parallelogram divides it into two equal parts, the proposition is established.

PROBLEMS.

39. Proposed by J. K. ELLWOOD, Principal of Colfax Schools, Pittsburg, Pennsylvania

If on the three sides of any plane triangle equilateral triangles be described, the lines joining the centres of these equilateral triangles form an equilateral triangle.

40. Proposed by J. C. CORBIN, Pine Bluff, Arkansas.

If R , r , r_1 , r_2 , and r_3 be, respectively, the radii of the circumscribed, inscribed, and escribed circles of a \triangle , prove $r_1 + r_2 + r_3 - r = 4R$.

41. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Find the length (x) of a rectangular parallelepiped $b=5$ ft. and $h=3$ ft., which can be *diagonally inscribed* in a similar parallelepiped $L=83$ ft., $B=64$ ft., and $H=50$ ft.

CALCULUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

26. Proposed by Professor J. F. W. SCHEFFER, M. A., Hagerstown, Maryland.

According to Bessel, the ratio of the squares of the polar diameter of the earth to that of the equatorial diameter, is .9933254. Find what *latitude* the angle made by a body falling to the earth, with a perpendicular to the surface, is greatest. Find, also, this maximum angle.

Solution by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Let ϕ = the required geographical latitude, and ϕ' = the geocentric latitude of the same place; then *Chauvenet's Spherical and Practical Astronomy*, Vol. I., p. 98, we deduce $\phi' = \tan^{-1}[(b^2/a^2)\tan\phi] = \tan^{-1}[(1-e^2)\tan\phi]$.

$$\therefore (\phi - \phi') = \phi - \tan^{-1}[(1-e^2)\tan\phi], = \text{a Maximum.}$$

$$\therefore \frac{d(\phi - \phi')}{d\phi} = 1 - \frac{(1-e^2)(1+\tan^2\phi)}{1+(1+e^2)^2\tan^2\phi} = 0.$$

$$\therefore \phi = \tan^{-1} \left[\sqrt{\left(\frac{1}{1-e^2} \right)} \right] = \tan^{-1}(1.0033541) = 45^\circ 5' 45''.32,$$

$$\text{and } \phi' = \tan^{-1}(.9966571) = 44^\circ 54' 14''.67.$$

Hence $(\phi - \phi') = 11' 30''.65$; and this result is found in the already-named *Manual of Astronomy*, Vol. II.; third Table, p. 577.

II. Solution by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Not taking into account the eastward deviation due to the rotation of the earth we can proceed as follows:

Let HEC be the direction the body falls, FEG the perpendicular to the earth's surface at E , DEK the tangent to the meridian at E , $CA=a$,